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(71)Applicant : NIPPON STEEL CORP

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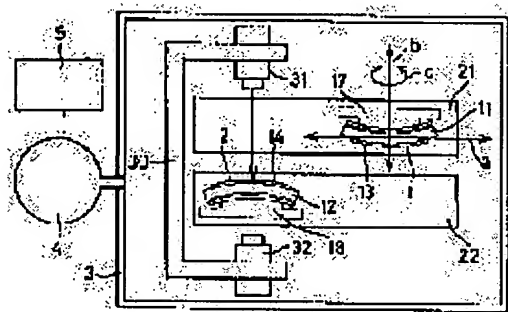
(72)Inventor : KAWASHIMA HIDEAKI

## (54) SEMICONDUCTOR SUBSTRATE ADHERING DEVICE

### (57)Abstract:

**PURPOSE:** To not generate an air bubble without adhering a moisture, dust, or the like to between two sheets of semiconductor substrates by a method wherein a device for manufacturing a multilayer device is received in a container and the inside thereof is held in an inactive gas atmosphere condition.

**CONSTITUTION:** Respective mechanisms such as adhesive members 11, 12, supporting members 17, 18, or the like are received in a chamber 3. The chamber 3 is provided with a pump 4 so that the entire inside of the chamber 3 can be made in an inactive gas atmosphere condition. The pump 4 is provided with a gas generator 5 for generating inactive gas. The inactive gas derived from the gas generator 5 is supplied into the chamber 3 by the pump 4. Thus, it is possible to prevent a generation of an air bubble, an adhesion of a moisture, dust, or the like, and a generation of an incompletely adhering part in a normal pressure between the two semiconductor substrates.



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CLAIMS

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[Claim(s)]

[Claim 1] Semi-conductor substrate pasting equipment which is equipment which manufactures the multilayer device which stuck two semi-conductor substrates, and is characterized by having the container which contains this equipment, and a means to hold the inside of this container in the inert gas ambient atmosphere condition.

[Claim 2] Are the pasting member of the couple which has the pasting side of the couple which holds two semi-conductor substrates, respectively, and one pasting side is deformable to a convex curved surface and a flat side. And that the pasting side of another side is deformable to a convex curved surface and a flat side or the pasting member of a couple which consisted of flat sides of immobilization, The driving means of said both semi-conductors substrate that was made to move at least one side of the pasting member of these couples, and was held in said both pasting side, respectively to which centers are contacted mostly, Semi-conductor substrate pasting equipment according to claim 1 further equipped with the deformation grant means made to transform a deformable pasting side into a flat side from a convex curved surface among said both pasting sides that hold said both semi-conductors substrate, respectively.

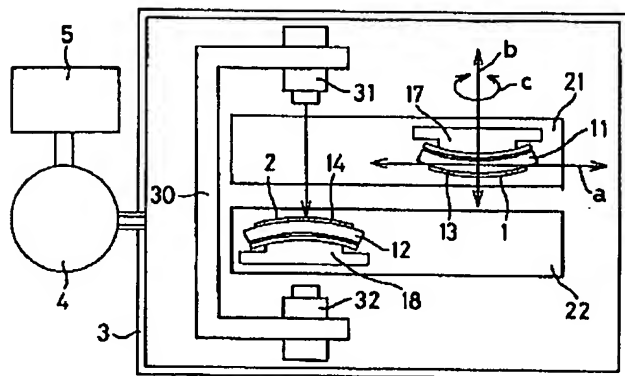
[Claim 3] Are the pasting member of the couple which has the pasting side of the couple which holds two semi-conductor substrates, respectively, and one pasting side is deformable to a convex curved surface and a flat side. And that the pasting side of another side is deformable to a convex curved surface and a flat side or the pasting member of a couple which consisted of flat sides of immobilization, A detection means to detect the mark beforehand formed in said both semi-conductors substrate held in said both pasting side, respectively, A storage means to memorize the location of the each mark of said both semi-conductors substrate detected by said detection means, At least one side of the pasting member of said couple is moved, and the relative position of said both semi-conductors substrate held in said both pasting side, respectively is adjusted. The driving means of these semi-conductors substrate to which centers are contacted mostly, Said driving means is controlled based on the location data of the each mark of said both semi-conductors substrate memorized by said storage means. Semi-conductor substrate pasting equipment according to claim 1 further equipped with the control means which performs alignment of said both semi-conductors substrate, and the deformation grant means made to transform a deformable pasting side into a flat side from a convex curved surface among said both pasting sides that hold said both semi-conductors substrate, respectively.

[Claim 4] Semi-conductor substrate pasting equipment according to claim 2 or 3 characterized by having formed the pasting member which has said deformable pasting side with the shape memory alloy, and constituting said deformation grant means with a heating means.

[Claim 5] Semi-conductor substrate pasting equipment according to claim 2 or 3 characterized by having formed the pasting member which has said deformable pasting side with the elastic body, and constituting said deformation grant means with a sticking-by-pressure means.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Industrial Application] In case this invention manufactures a multilayer device, it relates to the semi-conductor substrate pasting equipment for sticking two semi-conductor substrates.

[0002]

[Description of the Prior Art] There is the approach of sticking two semi-conductor substrates as one of the approaches which manufactures semi-conductor laminated circuit boards, such as a multilayer device, for example, SOI (Silicon On Insulator) structure etc. In two semi-conductor substrates which consist of the silicon by which mirror plane polishing was carried out, if the polished fields are contacted under pure conditions, a firm semi-conductor laminated circuit board and the so-called multilayer device will be obtained. Since this approach does not need to make dissimilar material, such as adhesives, intervene between semi-conductor substrates, it can perform subsequent high temperature processing and various subsequent chemical treatments like one semi-conductor substrate. Moreover, in this approach, since both the semi-conductors substrate that has various impurity temperature, thickness, a diffusion layer, etc. can be directly pasted up comparatively at low temperature and it can consider as one semi-conductor substrate, the impossible component structure can be manufactured with an epitaxial grown method. As equipment which sticks two semi-conductor substrates for that, alignment of both the semi-conductors substrate is performed, and the technique of making it contact from the center section of both the semi-conductors substrate is proposed as indicated by Japanese Patent Application No. No. 264489 [ two to ].

[0003]

[Problem(s) to be Solved by the Invention] However, in the approach of sticking two semi-conductor substrates which were mentioned above, and manufacturing a multilayer device, even if manufactured under the pure ambient atmosphere, moisture, dust, etc. adhered to the field which both the semi-conductors substrate sticks, air bubbles were generated, therefore the adhesion between both semi-conductors substrates fell, and there was a problem of causing the yield of a multilayer device and lowering of dependability.

[0004] Then, this invention aims at offering the semi-conductor substrate pasting equipment which can stick both the semi-conductors substrate with sufficient adhesion, without not making moisture, dust, etc. adhere between two semi-conductor substrates, but generating air bubbles further.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the semi-conductor substrate pasting equipment by this invention is equipment which manufactures the multilayer device which stuck two semi-conductor substrates, and is equipped with the container which contains this equipment, and a means to hold the inside of this container in the inert gas ambient atmosphere condition. Moreover, the above-mentioned semi-conductor substrate pasting equipment It is the pasting member of the couple which has the pasting side of the couple which holds two semi-conductor substrates, respectively. That the pasting side of another side is deformable to a convex curved surface and a flat side or the pasting member of a couple which consisted of flat sides of immobilization with one pasting side deformable to a convex curved surface and a flat side and, The driving means of said both semi-conductors substrate that was made to move at least one side of the pasting member of these

couples, and was held in said both pasting side, respectively to which centers are contacted mostly, What is further equipped with the deformation grant means made to transform a deformable pasting side into a flat side from a convex curved surface among said both pasting sides that hold said both semi-conductors substrate, respectively is desirable. Furthermore, the above-mentioned semi-conductor substrate pasting equipment It is the pasting member of the couple which has the pasting side of the couple which holds two semi-conductor substrates, respectively. That the pasting side of another side is deformable to a convex curved surface and a flat side or the pasting member of a couple which consisted of flat sides of immobilization with one pasting side deformable to a convex curved surface and a flat side and, A detection means to detect the mark beforehand formed in said both semi-conductors substrate held in said both pasting side, respectively, A storage means to memorize the location of the each mark of said both semi-conductors substrate detected by said detection means, At least one side of the pasting member of said couple is moved, and the relative position of said both semi-conductors substrate held in said both pasting side, respectively is adjusted. The driving means of these semi-conductors substrate to which centers are contacted mostly, Said driving means is controlled based on the location data of the each mark of said both semi-conductors substrate memorized by said storage means. What is further equipped with the control means which performs alignment of said both semi-conductors substrate, and the deformation grant means made to transform a deformable pasting side into a flat side from a convex curved surface among said both pasting sides that hold said both semi-conductors substrate, respectively is desirable. Moreover, what forms the pasting member which has said deformable pasting side with a shape memory alloy, and constitutes said deformation grant means with the heating means is desirable. Furthermore, what forms the pasting member which has said deformable pasting side with an elastic body, and constitutes said deformation grant means with the sticking-by-pressure means is desirable.

[0006]

[Function] The container which is equipment which manufactures the multilayer device which stuck two semi-conductor substrates according to the semi-conductor substrate pasting equipment of this invention constituted as mentioned above, and contains this equipment, Since it had a means to hold the inside of this container in the inert gas ambient atmosphere condition It is dry N2 about the inside of a container. It holds in the inert gas ambient atmosphere condition, such as helium. Two semi-conductor substrates can be stuck, and adhesion of generating of the air bubbles in the ordinary pressure between both semi-conductors substrates, moisture, dust, etc. and generating of an imperfect lamination part can be prevented, and it can stick with sufficient adhesion. Therefore, dependability can be made high while raising the yield of the multilayer device which sticks two semi-conductor substrates and is manufactured. According to the semi-conductor substrate pasting equipment constituted as mentioned above, moreover, before adhesion One [ at least ] pasting side of the pasting member of a couple is a convex curved surface, and two semi-conductor substrates are held in these pasting side, respectively. By the driving means both the semi-conductors substrate, if centers are contacted mostly and a pasting side is made to transform into a flat side from a convex curved surface with a deformation grant means Both the semi-conductors substrate is mostly stuck gradually from a center to the periphery section, and moreover, since it had the container which contains the equipment, and a means to hold the inside of the container in the inert gas ambient atmosphere condition It is dry N2 about the inside of a container. It holds in the inert gas ambient atmosphere condition, such as helium. Two semi-conductor substrates can be stuck, and adhesion of generating of the air bubbles in the ordinary pressure between both semi-conductors substrates, moisture, dust, etc. and generating of an imperfect lamination part can be prevented, and it can stick with sufficient adhesion. Therefore, dependability can be made high while raising the yield of the multilayer device which sticks two semi-conductor substrates and is manufactured. Furthermore, according to the semi-conductor pasting equipment constituted as mentioned above, the location of the each mark of both the semi-conductors substrate detected by the detection means is memorized by the storage means. Based on the location data of the each mark memorized by this storage means, a driving means is controlled by the control means. By this Before adhesion of both the semi-conductors substrate by the pasting member of a couple, alignment of both the semi-conductors substrate is extremely performed to accuracy, and moreover, since it had the container which can contain the equipment, and the means which changes the inside of the container into an inert gas ambient atmosphere condition It is dry N2 about the inside of a container. It holds in the inert gas

ambient atmosphere condition, such as helium. Two semi-conductor substrates can be stuck, and adhesion of generating of the air bubbles in the ordinary pressure between both semi-conductors substrates, moisture, dust, etc. and generating of an imperfect lamination part can be prevented, and it can stick with sufficient adhesion. Therefore, dependability can be made high while raising the yield of the multilayer device which sticks two semi-conductor substrates and is manufactured.

[0007]

[Example] Below, one example of the semi-conductor substrate pasting equipment by this invention is explained with reference to drawing 8 from drawing 1. Drawing 1 and drawing 2 show the time before adhesion of two semi-conductor substrates 1 and 2 by the pasting members 11 and 12 of a couple of adhesion, respectively. Moreover, drawing 3 - drawing 6 are the front views of the whole semi-conductor substrate pasting equipment at the time of carrying out alignment of both the semi-conductors substrates 1 and 2. Furthermore, drawing 7 is the top view of the semi-conductor substrates 1 and 2, and drawing 8 is the block diagram showing the configuration of an alignment control system.

[0008] The semi-conductor substrate pasting equipment of this example is equipped with the pasting members 11 and 12 of a couple as shown in drawing 1, and it is constituted identically, and these pasting members 11 and 12 counter mutually, and are arranged. The pasting members 11 and 12 are formed in disc-like with a shape memory alloy, and those front faces are the pasting sides 13 and 14 holding both the semi-conductors substrates 1 and 2. In addition, the outer diameter of the pasting members 11 and 12 is larger about 10mm than the outer diameter of both the semi-conductors substrates 1 and 2.

[0009] And as shown in drawing 1, the pasting members 11 and 12 deform into the bottom of the usual temperature of the environment where this semi-conductor substrate pasting equipment is used before adhesion of both the semi-conductors substrates 1 and 2 so that those pasting sides 13 and 14 may turn into a convex curved surface. Although these convex curved surface is the spherical surface ideally, in this example, it is a cylinder side. In addition, curvature is exaggerated and drawn in the drawing and the difference of the height of the core of the pasting sides 13 and 14 and the periphery section is about 2-3mm actually.

[0010] Moreover, as shown in drawing 2, the restoration configuration which the pasting members 11 and 12 of a shape memory alloy were made to memorize at the time of adhesion of both the semi-conductors substrates 1 and 2 is a configuration from which those pasting sides 13 and 14 turn into a flat side.

[0011] In addition, in the pasting member 11 and 12, the attraction holes 15 and 16 for vacuum adsorption are formed, and they are punctured by the pasting sides 13 and 14. And the pasting members 11 and 12 are supported by the supporter material 17 and 18 so that there may be no trouble in the deformation. Moreover, heaters 19 and 20 are attached in the supporter material 17 and 18 as a heating means by the rear-face side of the pasting members 11 and 12.

[0012] And as shown in drawing 3 - drawing 6, the supporter material 17 and 18 is attached in driving means 21 and 22 in the shape of level, respectively. The supporter material 17 and 18 is freely movable to the direction of right-and-left a, the direction of vertical b, and a cross direction (not perpendicularly shown to space), respectively, and is further constituted by these driving means 21 and 22 free [ a revolution ] in the direction of arrow-head c in the level surface.

[0013] Furthermore, each device of said pasting members 11 and 12, said supporter material 17, and 18 grades is contained in the chamber 3. This chamber 3 is equipped as the pump 4 for changing into an inert gas ambient atmosphere condition shows the whole inside of this chamber 3 in drawing.

Furthermore, in this pump 4, it is dry N<sub>2</sub>. It is equipped with the gas generator 5 which generates inert gas, such as helium, and the inert gas from a gas generator 5 is supplied in a chamber 3 with a pump 4. Therefore, the inside of this chamber 3 is N<sub>2</sub> always dried. N<sub>2</sub> which could maintain inert gas ambient atmosphere conditions, such as helium, and also always dried the lamination of both the semi-conductors substrates 1 and 2 It can carry out under inert gas ambient atmospheres, such as helium.

[0014] Thus, it is N<sub>2</sub> which always dried the inside of a chamber 3 since the semi-conductor substrate pasting equipment of this example contained each device mentioned above in the chamber 3 equipped with the pump 4 and the gas generator 5. It can hold in the inert gas ambient atmosphere condition, such as helium. Therefore, N<sub>2</sub> which dried two semi-conductor substrates 1 and 2 Since it can stick in the state of inert gas ambient atmospheres, such as helium, adhesion of generating of both the semi-

conductors substrate 1 and the air bubbles between two, moisture, dust, etc. can be prevented.

[0015] Next, actuation of the semi-conductor substrate pasting equipment constituted as mentioned above is explained. First, as shown in drawing 1, the pasting members 11 and 12 are deformed, those pasting sides 13 and 14 are convex curved surfaces, the actuator for deformation can be made to be able to build in the interior of the supporter material 17 and 18, or the pasting members 11 and 12 are made to stick to the mold for deformation by pressure before [ both ] adhesion of both the semi-conductors substrates 1 and 2, and they can perform the deformation. The semi-conductor substrates 1 and 2 are laid in the pasting sides 13 and 14 of the pasting members 11 and 12 which deformed, and it is held by the vacuum adsorption by the attraction holes 15 and 16. The semi-conductor substrates 1 and 2 are deformed into convex along the pasting sides 13 and 14 by this. It is N2 which dried the inside of a chamber 3 with the pump 4 and the gas generator 5 here. It is held at inert gas ambient atmosphere conditions, such as helium.

[0016] After performing alignment of the semi-conductor substrates 1 and 2 mentioned later, it is moved by driving means 21 and 22 and the pasting members 11 and 12 are approached by them. Contact of the centers of the semi-conductor substrates 1 and 2 suspends migration of the pasting members 11 and 12. And if the pasting members 11 and 12 are heated and specific temperature is reached at heaters 19 and 20, as shown in drawing 2, the pasting members 11 and 12 will carry out restoration deformation so that the configuration 13 and 14 made to memorize, i.e., pasting sides, may serve as a flat side.

[0017] Thus, by making the pasting sides 13 and 14 of the pasting members 11 and 12 transform into a flat side from a convex curved surface, it is stuck to two semi-conductor substrates 1 and 2, and when the pasting sides 13 and 14 turn into a flat side thoroughly, it becomes the completion of adhesion.

[0018] N2 which was dried according to this adhesion actuation Under inert gas ambient atmospheres, such as helium, since both the semi-conductors substrates 1 and 2 are gradually stuck from the center section in connection with deformation of the pasting sides 13 and 14 to the periphery section, air is confined between both the semi-conductors substrate 1 and 2, and air bubbles are not generated. Moreover, since thrust joins both the whole semi-conductors substrates 1 and 2 at the time of adhesion, both the semi-conductors substrate 1 and a lamination part imperfect among two do not arise, or both the semi-conductors substrates 1 and 2 do not exfoliate from the periphery section. Furthermore, since lateral force does not act on both the semi-conductors substrates 1 and 2, both the semi-conductors substrates 1 and 2 do not carry out a strike slip relatively.

[0019] Moreover, the above actuation is N2 always dried with the pump 4 and the gas generator 5. Since it is carried out in the chamber 3 which is in inert gas ambient atmosphere conditions, such as helium, in case two semi-conductor substrates 1 and 2 are stuck, adhesion of generating of air bubbles between both the semi-conductors substrate 1 and 2, moisture, and dust can be prevented, and it can stick with very sufficient adhesion.

[0020] Next, with reference to drawing 8, the alignment of two semi-conductor substrates 1 and 2 is explained from drawing 3. First, as shown in drawing 6 from drawing 3 R> 3, the mounting material 30 formed with the rigid body is arranged near the lamination location, and the cameras 31 and 32 of a couple are countered and attached in the vertical both ends of this mounting material 30. These cameras 31 and 32 can use a CCD camera. As are shown in drawing 3 R> 3, and a camera 31 picturizes the semi-conductor substrate 2 held in the pasting side 14 and shows it to drawing 4, a camera 32 picturizes the semi-conductor substrate 1 held in the pasting side 13.

[0021] Moreover, as shown in drawing 7, two marks P and Q for alignment are beforehand formed in the lamination side of both the semi-conductors substrates 1 and 2. In addition, these marks P and Q may use marks, such as semi-conductor substrate exposure by the stepper (cutback projection aligner).

[0022] Furthermore, as shown in drawing 8, the picture signal from cameras 31 and 32 is inputted into a control section 40, is sent out to the storage section 41 from the control section 40, and is memorized in the storage region where the storage sections 41 differ, respectively. Here, an image memory can be used for the storage section 41. And a control section 40 compares the location data of the marks P and Q of both the semi-conductors substrates 1 and 2 memorized by the storage section 41, respectively, and sends out a control signal to driving means 21 and 22 based on this.

[0023] Next, actuation of the semi-conductor substrate pasting equipment constituted as mentioned above is explained. First, as shown in drawing 3, at the time of the alignment of the semi-conductor substrate 2, the pasting member 11 and the semi-conductor substrate 1 are evacuated by the driving



means 21, with a camera 31, the semi-conductor substrate 2 is picturized and the image is memorized by the storage section 41.

[0024] Moreover, as shown in drawing 4, at the time of the alignment of the semi-conductor substrate 1, the pasting member 12 and the semi-conductor substrate 2 are evacuated by the driving means 22, with a camera 32, the semi-conductor substrate 1 is picturized and the image is memorized by the storage section 41.

[0025] And a control section 40 compares the location data of the marks P and Q of the semi-conductor substrate 1 and the location data of the marks P and Q of the semi-conductor substrate 2 which were memorized by the storage section 41, and sends out a control signal to driving means 21 and 22 based on the location data. N2 which the pasting members 11 and 12 were moved by driving means 21 and 22, and the alignment of both the semi-conductors substrates 1 and 2 dried by them as this showed to drawing 5 It is carried out in inert gas ambient atmosphere conditions, such as helium.

[0026] Thus, since it is carrying out based on the location data of the marks P and Q of both the semi-conductors substrates 1 and 2, alignment of both the semi-conductors substrates 1 and 2 can be extremely performed to accuracy, and generating of a defective can be prevented by it. Moreover, if it carries out based on location data, alignment to which the location of the each marks P and Q of both the semi-conductors substrates 1 and 2 estranges only a predetermined distance can also be performed. In this case, what is necessary is just to input a distance numeric value into a control section 40 from the exterior. Furthermore, since the pasting side 13 and the strike slip error of both the semi-conductors substrates 1 and 2 on 14 appear as location data and should just also input the installation error of cameras 31 and 32 as location data beforehand, those errors are absorbable if it carries out based on location data. In addition, since the pasting members 11 and 12 could rotate freely in the direction of arrow-head c in the level surface and have formed two marks P and Q in both the semi-conductors substrates 1 and 2, alignment which rotates both the semi-conductors substrates 1 and 2 in the level surface can also be performed.

[0027] As shown in drawing 6 after the above alignment, by driving means 21 and 22, the pasting members 11 and 12 are approached and both the semi-conductors substrate 1 and two comrades are contacted. And as drawing 2 described previously, both the semi-conductors substrate 1 and two comrades are stuck.

[0028] As mentioned above, although one example of this invention was explained, based on the technical thought of this invention, various kinds of effective modification is possible for this invention, without being limited to an example. For example, although both pasting sides were constituted from an example deformable in the convex curved surface and the flat side, the flat side of immobilization is satisfactory for one of the two. Moreover, although the driving means of the couple to which the pasting member of a couple is moved, respectively was established in the example, this driving means may move one pasting member.

[0029] In addition, when a pasting member is formed with a shape memory alloy, the heating means which is a deformation grant means may not be restricted to the heater of an example, but whole heating by a heat chamber etc. is sufficient as it. Moreover, a pasting member can be formed with the elastic body in which elastic deformation is possible, and the configuration made to transform the pasting side into a convex curved surface and a flat side can be adopted. In this case, a sticking-by-pressure means is used as a deformation grant means.

[0030] In addition, what is necessary is for the inside of the container which is not limited to this and can contain equipment, and the so-called chamber to be in an inert gas ambient atmosphere condition, and just to have established a means by which the inert gas ambient atmosphere condition is maintainable, although the pump and the gas generator are used for changing into an inert gas ambient atmosphere condition the inside of the container which contains equipment in the example of this invention. Moreover, inert gas is dry N2. Various kinds of effective inert gas can be used besides helium.

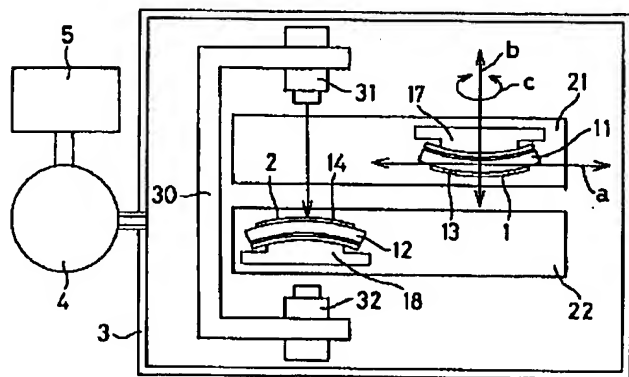
[0031]

[Effect of the Invention] Since it is equipment which manufactures the multilayer device which stuck two semi-conductor substrates according to this invention as explained above, and it had the container which contains this equipment, and a means to hold the inside of this container in the inert gas ambient atmosphere condition It is dry N2 about the inside of a container. It holds in the inert gas ambient

atmosphere condition, such as helium. While being able to stick two semi-conductor substrates, being able to prevent adhesion of generating of the air bubbles in the ordinary pressure between both semi-conductors substrates, moisture, dust, etc., and generating of an imperfect lamination part and being able to stick with sufficient adhesion. Mostly, from a center section, the alignment of the two semi-conductor substrates can be carried out to high degree of accuracy to the periphery section, and they can be stuck with very sufficient adhesion. Therefore, dependability can be made high while raising the yield of the multilayer device which sticks two semi-conductor substrates and is manufactured.

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Drawing selection ☒ Representative drawing

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